Sa 37/987

Preprint from the 1987

BUREAU OF MINES MINERALS YEARBOOK

Salt

UNITED STATES DEPARTMENT OF THE INTERIOR

I28.37/a:

READEX FICHE best copy available

UNITED STATES DEPARTMENT OF THE INTERIOR • Donald Paul Hodel, Secretary

BUREAU OF MINES • T S Ary, Director

This publication is a chapter from the current Bureau of Mines Minerals Yearbook, comprising *Volume I, Metals and Minerals; Volume II, Area Reports: Domestic; Volume III, Area Reports: International.* The separate volumes of the Yearbook are sold by the Superintendent of Documents, Washington, D.C. 20402.

Salt

By Dennis S. Kostick[1]

Production and sales of salt decreased for the second consecutive year because of a decline in demand for salt for water treatment and highway deicing.

Apparent consumption of salt decreased slightly in response to a decline in domestic demand and trade. Exports of salt decreased 54% to the lowest level since 1983. Imports for consumption of salt decreased 14%; the lowest level reported since 1982.

Domestic Data Coverage.—Domestic production data for salt are developed by the Bureau of Mines from two voluntary surveys of U.S. operations. Typical of the surveys is the salt company survey. Of the 74 operations to which a survey request was sent, 71 responded, representing 96% of the total production shown in table 1. Production for the three nonrespondents was estimated on the basis of their prior response to the 1987 production estimate survey.

Table 1.—Salient salt statistics

(Thousand short tons and thousand dollars)

	1983	1984	1985	1986	1987
United States:					
Production[1]	32,973	39,181	39,217	37,282	36,943
Sold or used by producers[1]	34,573	39,225	40,067	36,663	36,493
Value	$597,081	$675,099	$739,609	$665,460	$684,170
Exports	517	820	904	1,165	541
Value	$12,368	$15,299	$15,988	$16,928	$8,217
Imports for consumption	5,997	7,545	6,207	6,665	5,716
Value	$60,194	$74,100	$65,593	$79,709	$66,936
Consumption, apparent[2]	40,053	45,950	45,370	42,163	41,668
World: Production	r175,099	r190,070	191,628	p194,720	e195,594

eEstimated. pPreliminary. rRevised.
[1]Excludes Puerto Rico.
[2]Sold or used plus imports minus exports.

DOMESTIC PRODUCTION

The total quantity of all types of salt produced by domestic producers decreased slightly, based on an incomplete survey of the industry. Salt sold or used for captive purposes, primarily chloralkali manufacture, also decreased slightly. According to the Bureau of Mines survey for 1987, 33 companies operated 67 salt-producing plants in 15 States. Eight of the companies and 10 of the plants produced more than 1 million short tons each and accounted for 80% and 60%, respectively, of the U.S. total. Many individual companies and plants produced more than one type of salt. In 1987, 13 companies (19 operations) produced solar-evaporated salt; 7 companies (18 operations), vacuum pan and open pan salt; 10 companies (15 operations), rock salt; and 17 companies (27 operations), salt brine.

The five leading States in quantity of salt sold or used were Louisiana, 34%; Texas, 21%; New York, 13%; Ohio, 9%; and Kan-

sas, 5%. A significant quantity of the salt produced in Alabama, Kansas, Louisiana, New York, North Dakota, Ohio, Texas, Utah, and West Virginia was produced as brine, of which the majority was consumed captively to manufacture chlorine and caustic soda.

The percentage of salt sold or used by U.S. producers, by type, was as follows:

	1986	1987
Salt in brine	49	49
Mined rock	34	33
Vacuum pan salt and grainer or open pan salt	10	11
Solar-evaporated salt	7	7
Total	100	100

Diamond Crystal Salt Co. bought Sol-Aire Salt and Chemical Co. from AMAX Inc. at the beginning of the year. Sol-Aire had a solar salt complex on the Great Salt Lake in Utah. The acquisition allowed Diamond Crystal to expand its market, which predominantly was in the Eastern United States. However, later in the year, Diamond Crystal, once one of the largest domestic salt producers, was sold for $65 million to International Salt Co., a subsidiary of Akzo NV, a large Netherlands chemical corporation. Diamond Crystal, which operated salt facilities in Michigan, North Dakota, Ohio, and Utah, claimed that the sale was necessary because it was no longer competitive with large international salt companies.[2]

Geostow Inc., a joint venture of Geostock, a U.S. affiliate of a French company, and Northeastern Waste Systems Inc. of Buffalo, NY, acquired surface and underground cavity rights to 10,000 acres of mined-out sections of International Salt's Retsof rock salt mine in New York. Geostow plans to store ash containing dioxins from coal-burning powerplants and solid waste incinerators 1,200 feet below the surface, despite objections from the salt company and local residents. The State's Department of Environmental Quality favors incineration over landfills as a long-term solution to solid waste problems, and the Geostow project could accommodate all incinerator ash in New York for the next 28 to 50 years, if approved. The company filed for State permits at yearend.[3]

Table 2.—Salt production in the United States

(Thousand short tons)

Year	Vacuum pans and open pans	Solar	Rock	Brine	Total
1983	3,697	2,053	9,449	17,774	32,973
1984	3,629	2,705	13,653	19,195	[1]39,181
1985	3,613	2,549	13,990	19,065	39,217
1986	3,637	2,679	13,333	17,633	37,282
1987	3,776	3,120	12,230	17,817	36,943

[1]Data do not add to total shown because of independent rounding.

Table 3.—Salt produced in the United States, by product form and type

(Thousand short tons)

Product form	Vacuum pans and open pans	Solar	Rock	Brine	Total
1986					
Bulk	636	1,816	12,751	17,633	32,836
Compressed pellets	923	92	XX	XX	1,015
Packaged	1,769	678	515	XX	2,962
Pressed blocks	309	93	67	XX	469
Total	3,637	2,679	13,333	17,633	37,282
1987					
Bulk	682	2,220	11,671	17,817	32,390
Compressed pellets	984	99	XX	XX	1,083
Packaged	1,787	712	488	XX	2,987
Pressed blocks	324	90	71	XX	485
Total[1]	3,776	3,120	12,230	17,817	36,943

XX Not applicable.
[1]Data may not add to totals shown because of independent rounding.

Table 4.—Salt sold or used[1] in the United States, by product form and type

(Thousand short tons and thousand dollars)

Product form	Vacuum pans and open pans		Solar		Rock		Brine		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1986										
Bulk	606	25,842	1,701	23,745	11,927	151,786	17,920	92,210	32,154	293,583
Compressed pellets	920	88,686	93	6,194	XX	XX	XX	XX	1,013	94,880
Packaged:										
Less-than-5-pound units	151	NA	1	NA	34	NA	XX	XX	186	NA
More-than-5-pound units	1,600	NA	675	NA	570	NA	XX	XX	2,845	NA
Total	1,751	184,569	676	28,755	604	30,062	XX	XX	3,031	243,386
Pressed blocks:										
For livestock	148	NA	55	NA	1	NA	XX	XX	204	NA
For water treatment	158	NA	37	NA	66	NA	XX	XX	261	NA
Total	306	22,491	92	5,580	67	5,480	XX	XX	465	33,551
Grand total	3,583	321,588	2,562	64,274	12,598	187,328	17,920	92,210	36,663	665,400
1987										
Bulk	661	26,521	1,731	23,927	11,331	141,637	18,124	89,363	31,847	281,448
Compressed pellets	983	95,840	99	6,983	XX	XX	XX	XX	1,082	102,823
Packaged:										
Less-than-5-pound units	156	NA	1	NA	32	NA	XX	XX	189	NA
More-than-5-pound units	1,653	NA	705	NA	529	NA	XX	XX	2,888	NA
Total[2]	1,809	202,940	706	33,512	561	28,863	XX	XX	3,076	265,315
Pressed blocks:										
For livestock	156	NA	54	NA	1	NA	XX	XX	211	NA
For water treatment	167	NA	36	NA	72	NA	XX	XX	275	NA
Total[2]	323	22,857	90	6,090	73	5,637	XX	XX	487	34,584
Grand total[2]	3,776	348,158	2,627	70,513	11,965	176,137	18,124	89,363	36,493	684,170

NA Not available. XX Not applicable.

[1]As reported at salt production locations. The term "sold or used" indicates that some salt, usually salt brine, is not sold but is used for captive purposes by the plant or company. Because data do not include salt imported, purchased, or sold from inventory from regional distribution centers, salt sold or used by type may differ from totals shown in tables 7 and 8, which are derived from company reports.

[2]Data may not add to totals shown because of independent rounding.

Table 5.—Salt sold or used[1] by producers in the United States, by State

(Thousand short tons and thousand dollars)

State	1986		1987	
	Quantity	Value	Quantity	Value
Kansas[2]	1,656	68,887	1,689	70,148
Louisiana	11,608	103,611	12,498	108,999
New York	5,071	122,601	4,918	119,962
Ohio	4,115	126,757	3,276	104,099
Texas	8,520	62,996	7,810	60,857
Utah	1,112	31,830	1,108	34,264
Other[3]	4,581	148,718	5,194	185,841
Total	36,663	665,400	36,493	684,170
Puerto Rico[e]	40	880	40	900

[e]Estimated.
[1]The term "sold or used" indicates that some salt, usually salt brine, is not sold but is used for captive purposes by the plant or company.
[2]Quantity and value of brine included with "Other."
[3]Includes Alabama, Arizona, California, Kansas (brine only), Michigan, Nevada, New Mexico, North Dakota, Oklahoma, and West Virginia.

Table 6.—Evaporated salt sold or used[1] by producers in the United States, by State

(Thousand short tons and thousand dollars)

State	1986		1987	
	Quantity	Value	Quantity	Value
Kansas	856	60,221	893	61,263
Louisiana	193	18,747	212	20,086
New York	739	62,884	775	63,184
Utah	1,068	30,901	1,055	33,734
Other[2]	3,289	213,109	3,466	240,403
Total	6,145	385,862	[3]6,403	418,670
Puerto Rico[e]	40	880	40	900

[e]Estimated.
[1]The term "sold or used" indicates that some salt, usually salt brine, is not sold but is used for captive purposes by the plant or company.
[2]Includes Arizona, California, New Mexico, Michigan, North Dakota, Ohio, Oklahoma, and Texas.
[3]Data do not add to total shown because of independent rounding.

CONSUMPTION AND USES

Increased demand for caustic soda and chlorine in the alumina and pulp-bleaching markets, respectively, contributed to higher salt brine production and consumption for chloralkali manufacture. However, because of incomplete survey results, salt brine production and consumption totals are underreported for 1987. The chlorine and caustic soda industry, which traditionally has been the largest end-use market, required about 19.7 million tons of salt for feedstock, based on the stoichiometric calculation of 1.8 tons of salt needed to produce 1 ton of chlorine and 1.1 tons of coproduct caustic soda. Because many chloralkali companies closed or placed on standby plants that were uneconomic to maintain, the industry reached a record high 98% average effective capacity utilization in 1987 compared with 89% achieved in 1986.

Production of chlorine gas and sodium hydroxide, as reported by the Bureau of the Census, was as follows, in thousand short tons:

	1986[r]	1987
Chlorine gas (100%)	10,436	10,980
Sodium hydroxide, liquid (100%)	10,691	11,518

[r]Revised.

Chevron Chemical Co. began producing a new road deicer made of calcium-magnesium-acetate (CMA), which is reportedly one-fifteenth as corrosive as salt. Although CMA costs about $400 per ton and rock salt sells for only about $15 per ton, tests proceeded on CMA as a salt substitute on roads in environmentally sensitive areas in California, Michigan, and Wisconsin.

Table 7.—Distribution of domestic and imported salt by producers in the United States, by end use and type

(Thousand short tons)

End use	SIC	Vacuum pans and open pans		Solar		Rock		Salt in brine	Total[1]		
		Domestic	Imported	Domestic	Imported	Domestic	Imported		Domestic	Imported	Grand
1986											
Chemical:											
Chloralkali producers	2812	40	--	406	W	1,313	W	16,856	18,615	368	18,983
Other chemical	28 (excludes 2812, 2899)	373	W	91	W	241	W	51	757	62	818
Total		413	W	497	228	1,554	W	16,907	19,372	430	19,801
Food-processing industry:											
Meat packers	201	159	W	93	11	164	W	--	417	19	436
Dairy	202	94	--	2	3	3	(2)	--	100	3	103
Canning	2091, 203	118	(2)	39	27	79	5	1	238	33	271
Baking	205	116	(2)	7	W	8	W	--	132	2	134
Grain mill products	204 (excludes 2047)	61	--	(2)	W	16	W	--	77	2	79
Other food processing	206-208, 2047, 2099	130	W	14	9	41	W	(2)	186	16	202
Total[1]		680	5	157	53	312	17	1	1,150	75	1,225
General industrial:											
Textiles and dyeing	22	85	W	30	W	35	(2)	4	154	72	226
Metal processing	33, 34, 35, 37	14	(2)	12	9	265	4	(2)	291	13	304
Rubber	2822, 30 (excludes 3079)	2	--	2	1	3	--	125	132	1	133
Oil	13, 29	40	--	288	11	63	1	222	614	13	627
Pulp and paper	26	20	W	178	29	73	(2)	5	276	31	307
Tanning and/or leather	311	11	(2)	62	2	76	W	--	148	4	152
Other industrial	9621	85	(2)	77	W	51	W	1	214	54	268
Total[1]		256	41	649	131	566	16	357	1,829	188	2,017
Agricultural:											
Feed retailers and/or dealers-mixers		374	W	245	33	279	W	(2)	898	42	940
Feed manufacturers	2048	66	W	147	W	157	(2)	--	370	18	388
Direct-buying end users	02	17	W	11	W	7	(2)	--	36	1	37
Total		457	8	403	W	443	W	(2)	1,304	61	1,365

See footnotes at end of table.

Table 7.—Distribution of domestic and imported salt by producers in the United States, by end use and type —Continued

(Thousand short tons)

End use	SIC	Vacuum pans and open pans		Solar		Rock		Salt in brine	Total[1]		
		Domestic	Imported	Domestic	Imported	Domestic	Imported		Domestic	Imported	Grand
1986 —Continued											
Water treatment:											
Government (Federal, State, local)	2899	22	W	100	W	223	5	1	347	20	367
Commercial or other	2899	19	--	66	W	37	W	13	135	23	158
Total[1]		41	W	166	37	261	W	14	483	43	525
Ice control and/or stabilization:											
Government (Federal, State, local)	9621	6	W	132	W	7,979	1,826	1	8,118	2,079	10,197
Commercial or other	5159	19	W	12	W	288	W	--	319	24	343
Total		25	1	144	277	8,267	1,826	1	8,437	2,104	10,541
Distributors:											
Agricultural distribution	5159	70	W	80	W	82	W	--	232	54	286
Grocery wholesalers and/or retailers	514, 54	629	W	136	55	120	W	--	885	61	946
Institutional wholesalers and end users.	58, 70	25	W	4	W	114	W	--	143	6	150
Water-conditioning distribution	7399	291	W	259	216	249	W	(2)	799	229	1,028
U.S. Government resale	9199	6	--	1	W	1	W	--	8	1	9
Other wholesalers and/or retailers	5251	660	W	138	185	552	W	--	1,350	206	1,556
Total[1]		1,681	22	619	478	1,118	59	(2)	3,418	559	3,975
Other n.e.s.[3]		77	7	138	16	209	19	329	753	42	795
Grand total[1]		3,629	101	2,776	1,273	12,730	2,127	17,610	36,745	[4]3,501	40,246

1987

Chemical:											
Chloralkali producers	2812	48	--	355	W	1,361	W	16,066	17,830	125	17,955
Other chemical	28 (excludes 2812, 2899)	355	W	94	41	216	W	422	687	73	760
Total		383	W	449	41	1,577	W	16,108	18,517	198	18,715
Food-processing industry:											
Meat packers	201	172	W	46	8	216	W	--	434	18	452
Dairy	202	103	--	3	2	3	W	(2)	108	2	110
Canning	2091, 203	133	W	38	26	92	W	1	264	32	296
Baking	205	139	--	9	W	9	W	--	157	1	158
Grain mill products	204 (excludes 2047)	64	--	1	W	11	--	--	76	(2)	76
Other food processing	206-208, 2047, 2099	148	W	25	10	40	W	(2)	213	16	229
Total		759	5	122	46	371	17	1	1,252	69	1,321
General industrial:											
Textiles and dyeing	22	95	W	11	33	39	W	5	150	87	237
Metal processing	33, 34, 35, 37	14	W	11	12	269	W	(2)	294	17	311
Rubber	2822, 30 (excludes 3079)	1	--	3	W	3	W	138	145	W	145
Oil	13, 29	44	--	267	W	66	W	201	577	20	597
Pulp and paper	26	25	W	228	36	82	W	13	348	39	387
Tanning and/or leather	311	14	W	39	W	68	W	--	120	4	124
Other industrial	9621	100	W	63	17	58	W	3	224	23	247
Total[1]		293	56	622	119	585	16	361	1,858	191	2,049
Agricultural:											
Feed retailers and/or dealers-mixers	2048	401	W	201	37	345	W	--	947	48	995
Feed manufacturers	02	66	--	95	W	233	W	--	394	22	416
Direct-buying end users		18	--	13	W	10	W	--	41	1	42
Total		485	W	309	59	588	W	--	1,382	71	1,453

See footnotes at end of table.

Table 7.—Distribution of domestic and imported salt by producers in the United States, by end use and type —Continued

(Thousand short tons)

End use	SIC	Vacuum pans and open pans		Solar		Rock		Salt in brine	Total[1]		
		Domestic	Imported	Domestic	Imported	Domestic	Imported		Domestic	Imported	Grand
1987 —Continued											
Water treatment:											
Government (Federal, State, local)	2899	22	—	27	13	182	W	2	212	15	227
Commercial or other	2899	18	—	81	14	40	W	11	150	15	165
Total		40	—	108	27	202	W	13	362	30	392
Ice control and/or stabilization:											
Government (Federal, State, local)	9621	5	1	128	168	7,645	1,508	3	7,791	1,676	9,467
Commercial or other	5159	13	1	28	16	272	82	—	313	98	411
Total		18	2	166	184	7,917	1,590	3	8,104	1,774	9,878
Distributors:											
Agricultural distribution	5159	78	W	71	W	105	W	—	254	48	302
Grocery wholesalers and/or retailers	514, 54	646	W	175	W	121	W	—	942	65	1,007
Institutional wholesalers and end users	58, 70	28	—	4	W	99	W	(2)	130	7	137
Water-conditioning distribution	7399	309	W	276	W	229	W	(2)	814	249	1,063
U.S. Government resale	9199	7	—	3	W	1	W	(2)	11	1	12
Other wholesalers and/or retailers	5251	703	W	114	W	647	W	(2)	1,483	197	1,680
Total		1,771	18	643	471	1,202	79	(2)	3,614	567	4,181
Other n.e.s.[3]		104	4	348	27	182	24	1,080	1,634	55	1,749
Grand total[3]		3,851	116	2,767	975	12,693	1,887	17,567	36,788	[4]2,957	39,747

W Withheld to avoid disclosing company proprietary data; included in "Total" and "Grand Total."

[1]Data may not add to totals shown because of independent rounding. Because data includes salt imported, produced, and/or sold from inventory from regional distribution centers, salt sold or used by type may differ from totals shown in tables 1, 4, 5, and 6, which are derived from plant reports at salt production locations. Data may differ from totals shown in table 8 because of changes in inventory and/or incomplete data reporting.

[2]Less than 1/2 unit.

[3]Includes exports.

[4]Imported for distribution by U.S. producers; included in totals in tables 11, 12, and 13.

Table 8.—Distribution of domestic and imported evaporated and rock salt[1] in the United States, by destination

(Thousand short tons)

Destination	1986			1987		
	Evaporated		Rock	Evaporated		Rock
	Vacuum pans and open pans	Solar		Vacuum pans and open pans	Solar	
Alabama	48	[2]	330	52	[2]	354
Alaska	8	W	--	1	W	--
Arizona	6	58	3	7	61	W
Arkansas	31	1	56	33	W	60
California	150	842	1	157	900	W
Colorado	19	125	51	19	101	80
Connecticut	11	11	223	11	11	283
Delaware	2	32	7	2	14	28
District of Columbia	1	[2]	W	1	[2]	W
Florida	90	W	30	93	67	29
Georgia	67	W	81	77	28	88
Hawaii	W	W	--	W	W	--
Idaho	5	78	W	6	60	W
Illinois	356	79	1,134	372	67	1,002
Indiana	149	32	650	154	40	605
Iowa	151	43	250	162	43	211
Kansas	93	17	259	96	20	298
Kentucky	39	W	388	41	W	440
Louisiana	44	W	320	54	W	352
Maine	6	W	223	6	64	150
Maryland	46	W	163	47	107	237
Massachusetts	33	46	531	36	8	656
Michigan	W	W	1,527	242	19	927
Minnesota	145	127	369	168	130	282
Mississippi	23	[2]	W	21	[2]	115
Missouri	112	17	302	120	19	418
Montana	2	34	W	2	42	W
Nebraska	86	32	172	93	35	133
Nevada	W	W	W	W	186	W
New Hampshire	2	W	W	2	22	191
New Jersey	128	153	290	118	172	281
New Mexico	6	W	2	5	W	2
New York	248	W	W	258	97	2,092
North Carolina	152	85	W	173	102	71
North Dakota	37	10	5	53	11	7
Ohio	W	19	1,596	328	24	1,351
Oklahoma	38	W	6740	W	69	--
Oregon	W	55	--	11	56	1
Pennsylvania	162	104	1,015	172	119	1,039
Rhode Island	6	4	W	5	3	105
South Carolina	38	W	12	40	9	13
South Dakota	39	26	39	44	26	35
Tennessee	67	[2]	625	69	[2]	610
Texas	153	82	197	160	92	208
Utah	4	169	W	4	192	W
Vermont	6	W	189	6	W	152
Virginia	75	120	106	77	117	201
Washington	W	406	[2]	18	222	[2]
West Virginia	16	W	172	14	W	181
Wisconsin	223	48	927	223	53	707
Wyoming	W	24	1	1	28	1
Other[3]	598	835	2,720	71	375	464
Total[4]	3,716	3,713	15,040	3,965	3,742	14,470

W Withheld to avoid disclosing company proprietary data; included with "Other."

[1]Each salt type includes domestic and imported quantities. Excludes brine because it usually is not shipped out of State.

[2]Less than 1/2 unit.

[3]Includes shipments to overseas areas administered by the United States, Puerto Rico, exports, some shipments to unspecified destinations, and shipments to States indicated by symbol W.

[4]Data may not add to totals shown because of independent rounding. Because data includes salt imported, purchased, and/or sold from inventory from regional distribution centers, evaporated and rock salt distributed by State may differ from totals shown in tables 1, 4, 5, and 6, which are derived from plant reports at salt production locations. Data may differ from totals shown in table 7 because of changes in inventory and/or incomplete data reporting.

The reported percent distribution of salt by major end use in 1987 was chemicals, 47%; ice control, 25%; distributors, 11%; food and agricultural, 7%; industrial, 5%; water treatment, 1%; and other combined with exports, 4%. For a complete end-use analysis in table 7, specific sectors of distribution, such as agricultural and water-treatment conditioning, can be combined with the primary agricultural and water categories.

STOCKS AND PURCHASES

Total yearend stocks reported by producers were 2.0 million tons. Most of these stocks were rock salt and solar salt. Many States, municipalities, distributors, and road-deicing contractors stockpiled additional quantities of salt in anticipation of adverse weather conditions.

Intraindustry purchases of salt amounted to 1.7 million tons, of which 65% was salt brine; rock salt, 23%; vacuum pan salt, 8%; and solar salt, 4%.

PRICES

Price quotations are not synonymous with average values reported to the Bureau of Mines. The quotations do not necessarily represent prices at which transactions actually occurred, nor do they represent bid and asked prices. They are quoted here to serve only as a reference to yearend price levels. The following yearend prices were quoted in Chemical Marketing Reporter:[4]

Salt, evaporated, common, 80-pound bags, carlots or truckloads, North, works, 80 pounds	$4.02
Salt, chemical-grade, same basis, 80 pounds	4.30
Salt, rock, medium coarse, same basis, 80 pounds	2.70
Bulk, same basis, per ton	$18.00-25.00
Sodium chloride, USP granular bags, per pound	0.29

Table 9.—Average values[1] of salt, by product form and type

(Dollars per short ton)

Product form	Vacuum pans and open pans	Solar	Rock	Brine
1986				
Bulk	42.65	13.95	12.79	5.15
Compressed pellets	96.37	66.66	XX	XX
Packaged	105.44	42.53	49.77	XX
Average[2]	91.27	23.76	14.51	5.15
Pressed blocks	73.61	60.47	81.42	XX
1987				
Bulk	40.12	13.82	12.50	4.93
Compressed pellets	97.50	70.54	XX	XX
Packaged	112.18	47.47	51.45	XX
Average[2]	94.21	25.40	14.34	4.93
Pressed blocks	70.76	67.67	77.22	XX

XX Not applicable.

[1]Net selling value, f.o.b. plant, excluding container costs.

[2]Salt value data previously reported were an aggregate value per ton of bulk, compressed pellets, and packaged salt. For time series continuity, an average of these three types of product forms is presented, which is based on the aggregated values and quantities of the product form for each type of salt shown in table 4.

FOREIGN TRADE

Although the United States imported nearly 11 times the quantity of salt that it exported, reduced domestic demand for salt resulted in a decrease in salt imports, primarily from Canada. This decrease in imports from Canada created a surplus in the Canadian salt supply, thereby affecting U.S. exports to Canada, which represented about 88% of the total U.S. export market. The balance of exports was distributed to 37 other countries.

More than 99% of total salt imports was bulk rock salt and solar salt. The Bahamas, Canada, Chile, and Mexico supplied 84% of total imports. The total for imports of bulk salt was adjusted by the Bureau of Mines to

correct for an August 1987 shipment from Italy through the Philadelphia customs district, which was erroneously reported as 2.2 million tons instead of 22,000 tons.

Imports of salt in bags, sacks, barrels, and brine, primarily from Canada, the Federal Republic of Germany, the Republic of Korea, the Netherlands, and the United Kingdom, represented the remainder of imports.

Table 10.—U.S. exports of salt, by country

(Thousand short tons and thousand dollars)

Country	1986		1987	
	Quantity	Value	Quantity	Value
Argentina	[1]	20	1	13
Australia	[1]	14	[1]	30
Bahamas	[1]	45	1	28
Brazil	42	704	--	--
Canada	1,091	13,265	477	6,839
Costa Rica	[1]	99	[1]	8
Denmark	2	17	[1]	22
Dominican Republic	[1]	31	3	65
Ecuador	1	234	--	--
Honduras	[1]	10	[1]	14
Kenya	[1]	171	--	--
Mexico	10	334	26	489
Netherlands Antilles	1	82	[1]	27
Saudi Arabia	6	1,170	24	421
South Africa, Republic of	[1]	4	--	--
United Arab Emirates	[1]	10	1	12
United Kingdom	6	195	--	--
Venezuela	[1]	22	[1]	4
Other	6	501	8	245
Total	1,165	16,928	541	8,217

[1]Less than 1/2 unit.

Source: Bureau of the Census; figures adjusted by the Bureau of Mines.

Table 11.—U.S. imports for consumption of salt

(Thousand short tons and thousand dollars)

Year	In bags, sacks, barrels, or other packages (dutiable)		Bulk (dutiable)	
	Quantity	Value	Quantity	Value
1984	71	2,386	[2]7,474	[2]71,714
1985	66	3,794	[3]6,141	[3]61,799
1986	70	3,170	[3]6,595	[3]76,589
1987	44	5,122	[4]5,672	[4]61,814

[1]Includes salt brine from Hong Kong, Iceland, and the United Kingdom through New York, NY, customs district, 500 pounds ($940); from the Federal Republic of Germany and Norway, through Chicago, IL, customs district, 110 short tons ($3,299); from Denmark through Detroit, MI, customs district, 23 short tons ($191); and from Japan through Charleston, SC, customs district, 110 pounds ($527).

[2]Includes salt brine from Spain through New York, NY, customs district, 1,987 short tons ($27,620); from Denmark through Cleveland, OH, customs district, 935 short tons ($76,714); from Japan through Charleston, SC, customs district, 691 short tons ($4,620); from Switzerland through Chicago, IL, customs district, 28 short tons ($2,533); and from the Federal Republic of Germany through Washington, DC, customs district, an undisclosed quantity valued at $5,444.

[3]Includes salt brine from Norway through Los Angeles, CA, customs district, 200 pounds ($1,606); from Denmark through Cleveland, OH, 3 short tons ($16,360); from the Federal Republic of Germany through Chicago, IL, 277 short tons ($12,834); and from Switzerland through Chicago, IL, 1,000 pounds ($3,588).

[4]Includes salt brine from Canada through Buffalo, NY, customs district, 79 short tons ($3,389); from Norway through Los Angeles, CA, customs district, 10 short tons ($1,396); from Denmark through Cleveland, OH, customs district, 4 short tons ($48,221); and from the Federal Republic of Germany through New York, NY, customs district, 708 short tons ($14,472). Data were adjusted to correct for erroneous notation of shipment from Italy in August.

Source: Bureau of the Census; figures adjusted by the Bureau of Mines.

Table 12.—U.S. imports for consumption of salt, by country

(Thousand short tons and thousand dollars)

Country	1986		1987	
	Quantity	Value	Quantity	Value
Bahamas	915	9,798	965	7,765
Canada[1]	2,944	26,932	2,002	24,330
Chile	312	3,153	415	3,682
France[2]	101	1,974	66	546
German Democratic Republic	—	—	14	63
Germany, Federal Republic of[3]	6	315	7	394
Italy[4]	135	2,289	[5]204	417
Mexico[6]	1,711	26,239	1,409	16,212
Netherlands	213	4,047	203	4,002
Netherlands Antilles	61	1,100	230	3,350
Spain[7]	124	1,351	41	446
Other	143	2,411	5,716	66,936
Total	6,665	79,709	5,716	66,936

[1]Includes salt in bags, sacks, and barrels through 7 customs districts, 34,241 short tons ($2,187,191) in 1986; and 10 customs districts, 32,050 short tons ($2,242,384) in 1987.

[2]Includes salt in bags, sacks, and barrels through 5 customs districts, 3,041 short tons ($69,401) in 1986; and 3 customs districts, 222 short tons ($77,933) in 1987.

[3]Includes salt in bags, sacks, and barrels through 8 customs districts, 6,152 short tons ($287,031) in 1986; and 6 customs districts, 2,542 short tons ($304,426) in 1987.

[4]Includes salt in bags, sacks, and barrels through 3 customs districts, 10 short tons ($156,204) in 1986; and 2 customs districts, 85 short tons ($28,123) in 1987.

[5]Adjusted to correct erroneous notation of shipment in August.

[6]Includes salt in bags, sacks, and barrels through 2 customs districts, 67 short tons ($12,295) in 1986; and 1 customs district, 273 short tons ($38,155) in 1987.

[7]Includes salt in bags, sacks, and barrels through 1 customs district, 1 short ton ($1,038) in 1986; and 2 customs districts, 32 short tons ($14,279) in 1987.

Source: Bureau of the Census; figures adjusted by the Bureau of Mines.

Table 13.—U.S. imports for consumption of salt, by customs district

(Thousand short tons and thousand dollars)

Customs district	1986		1987	
	Quantity	Value	Quantity	Value
Anchorage, AK	[1]	90	[1]	12
Baltimore, MD	311	3,241	269	2,643
Boston, MA	43	989	11	924
Buffalo, NY	1	61	5	85
Chicago, IL	355	4,137	165	2,125
Cleveland, OH	23	240	48	616
Detroit, MI	1,256	11,543	640	8,234
Duluth, MN	59	554	79	798
Los Angeles, CA	132	2,306	127	1,949
Milwaukee, WI	853	5,546	456	5,435
New Orleans, LA	194	2,424	203	2,545
New York, NY	345	6,696	508	5,678
Norfolk, VA	73	877	144	1,262
Ogdensburg, NY	11	120	118	1,218
Philadelphia, PA	189	2,552	[2]579	3,182
Portland, ME	510	4,265	465	5,092
Portland, OR	595	8,884	427	5,361
Providence, RI	259	2,754	255	2,682
St. Albans, VT	6	174	1	54
San Juan, PR	21	381	16	287
Savannah, GA	361	3,797	396	3,625
Seattle, WA	639	11,680	464	5,369
Tampa, FL	129	1,401	56	1,066
Wilmington, NC	287	4,838	255	4,242
Other	7	149	29	2,352
Total	6,665	79,709	5,716	66,936

[1]Less than 1/2 unit.

[2]Adjusted to correct erroneous notation of shipment from Italy in August.

Source: Bureau of the Census; figures adjusted by the Bureau of Mines.

WORLD REVIEW

Botswana.—The Government formed a joint venture with African Explosives and Chemical Industries Inc. of the Republic of South Africa to produce soda ash and salt from underground brines in the Sua Pan. The project was anticipated to produce 600,000 tons of salt annually.[5]

China.—The largest known salt deposit in China was discovered in Jiangsu Province. The deposit contained reserves of 200 to 400 million tons of salt. Two other deposits with reserves of 44 million and 3 million tons were also discovered in Jiangsu.[6] Near Laizhou Bay in Shandong Province, an underground salt brine deposit was discovered containing about 400,000 tons of salt.[7] Once developed, these deposits are expected to provide salt as feedstock for many proposed chemical and industrial projects in China.

Table 14.—Salt: World production, by country[1]

(Thousand short tons)

Country[2]	1983	1984	1985	1986[p]	1987[e]
Afghanistan[e]	11	11	11	11	11
Albania[e]	80	80	80	82	83
Algeria	[e]165	193	185	209	220
Angola[e]	60	55	11	11	11
Argentina:					
Rock salt	1	1	1	1	1
Other salt	746	[r]1,032	1,595	1,342	1,300
Australia (marine salt and brine salt)	5,699	6,278	[e]6,800	[e]6,800	6,800
Austria:					
Rock salt	1	1	1	2	1
Evaporated salt	396	462	483	536	500
Salt in brine	155	263	254	276	280
Bahamas[e]	950	960	940	[3]1,092	[3]894
Bangladesh[4]	268	741	539	[e]550	550
Benin[e]	[5]	[5]	[5]	[5]	[5]
Brazil:					
Rock salt	[e]1,023	1,046	1,097	[e]1,100	1,100
Marine salt	[e]3,582	3,944	1,911	[e]2,800	2,800
Bulgaria	95	98	98	100	100
Burma[7]	317	309	353	354	370
Cambodia[e]	45	45	45	45	45
Canada	9,482	11,282	11,117	11,389	11,000
Chile	788	690	831	1,138	960
China[e]	17,780	17,950	[3]15,924	19,070	19,800
Colombia:					
Rock salt	[r]299	299	260	250	[3]226
Marine salt	[r]466	[r]732	545	552	[3]496
Costa Rica (marine salt)[e]	120	120	[3]33	33	33
Cuba	198	204	244	254	250
Cyprus			8	7	7
Czechoslovakia	265	268	[e]270	[e]270	270
Denmark	449	577	586	[e]550	550
Dominican Republic[e]	70	70	[3]52	60	60
Egypt	1,012	953	1,170	[e]1,400	1,400
El Salvador[e]	2	3	3	3	3
Ethiopia[e 4]					
Rock salt	17	17	17	17	17
Marine salt	121	130	130	130	130
France:					
Rock salt	311	249	407	425	410
Brine salt	1,184	1,240	1,272	1,240	1,250
Marine salt	1,493	1,522	1,569	1,775	1,820
Salt in solution	4,673	4,869	4,593	4,368	4,410
German Democratic Republic:					
Rock salt	3,384	3,390	3,395	3,390	3,390
Marine salt	62	64	64	65	65
Germany, Federal Republic of: Marketable:					
Rock salt	6,906	7,837	10,642	10,048	10,100
Marine salt and other salt	5,074	5,624	8,765	4,395	4,400
Ghana[e]	55	55	55	55	55
Greece	176	146	165	[e]165	165
Guatemala	17	[e]18	19	43	[3]41
Honduras[e]	35	35	35	35	35
Iceland	1	1	1	[e]2	2

See footnotes at end of table.

Table 14.—Salt: World production, by country[1] —Continued

(Thousand short tons)

Country[2]	1983	1984	1985	1986[p]	1987[e]
India:					
Rock salt[e]	[3]5	6	4	[r]2	2
Marine salt	7,725	8,514	10,885	11,151	12,100
Indonesia	681	408	[4]660	550	
Iran[e]	752	762	775	[r e]770	770
Iraq[e]	90	90	80	80	80
Israel[e]	160	160	170	170	170
Italy:					
Rock salt and brine salt	3,807	3,588	3,501	3,784	3,600
Marine salt[e]	811	797	628	[e]660	640
Japan[10]	1,015	1,053	[e]1,300	1,510	[3]1,540
Jordan	37	24	35	[e]35	35
Kenya:					
Rock salt	[e]70	80	73	[r e]70	70
Other salt	[e]26	31	28	39	40
Korea, North[e]	630	630	630	630	630
Korea, Republic of	530	571	709	804	[3]732
Kuwait	[e]22	23	23	[e]23	23
Laos[e]	11	9	11	33	33
Lebanon[e]	6	6	6	6	6
Leeward and Windward Islands[e]	55	55	55	55	55
Libya[e]	13	13	13	13	13
Madagascar[e]	33	33	33	33	33
Mali[e]	5	5	5	5	5
Malta	(5)	(5)	(5)	[e](5)	(5)
Mauritania[e]	6	6	6	6	6
Mauritius[e]	7	7	7	7	7
Mexico	6,287	6,798	7,129	6,533	6,600
Mongolia[e]	18	18	18	18	18
Morocco	77	69	102	106	[3]119
Mozambique[e]	30	30	30	30	30
Namibia (marine salt)	151	97	168	[e]150	150
Netherlands	3,444	4,050	4,579	4,148	[3]4,386
Netherlands Antilles[e]	[3]312	390	390	390	390
New Zealand	89	63	[e]70	[e]70	70
Nicaragua[e]	20	17	17	17	17
Niger[e]	3	3	3	3	3
Pakistan:[4]					
Rock salt	629	659	643	635	550
Other salt	[e]210	[e]200	296	267	320
Panama (crude)	[11]94	20	18	11	11
Peru	165	279	226	440	440
Philippines	421	442	464	866	550
Poland:					
Rock salt	1,246	1,306	1,323	1,346	[3]1,357
Other salt	2,750	3,887	4,040	4,630	[3]5,442
Portugal:					
Rock salt	467	502	510	506	510
Marine salt[e]	120	120	130	120	120
Romania	5,066	5,373	5,532	5,903	5,950
Senegal	190	182	176	160	110
Sierra Leone[e]	220	220	220	220	220
Somalia[e]	33	33	33	33	33
South Africa, Republic of	820	679	796	829	[e]776
Spain:					
Rock salt	2,214	2,376	2,381	[e]2,300	2,300
Marine salt and other evaporated salt	1,267	1,359	1,190	[e]1,100	1,100
Sri Lanka	142	118	85	115	[3]127
Sudan	80	80	[3]42	44	44
Switzerland	349	410	412	[e]400	410
Syria	96	96	[e]100	[e]100	100
Taiwan	87	241	206	150	[3]240
Tanzania	31	24	23	24	25
Thailand:					
Rock salt	6	11	14	2	5
Other salt[e]	180	180	180	180	180
Tunisia	413	364	421	457	460
Turkey	1,390	1,422	1,311	1,292	[3]1,342
Uganda[e]	6	6	6	6	6
U.S.S.R.	17,857	18,200	17,747	[e]17,700	17,700
United Kingdom:					
Rock salt	1,451	1,730	2,238	[e]2,200	2,200
Brine salt[12]	1,537	1,569	1,711	[e]1,700	1,700
Other salt[12]	3,969	4,557	3,928	[e]3,900	3,900

See footnotes at end of table.

Table 14.—Salt: World production, by country[1] —Continued

(Thousand short tons)

Country[2]	1983	1984	1985	1986[p]	1987[e]
United States including Puerto Rico (sold or used by producers):					
Rock salt	9,941	13,355	14,699	12,598	[3]11,965
Other salt:					
United States	24,632	25,871	25,377	24,065	[3]24,527
Puerto Rico[e]	32	30	35	40	40
Venezuela[e]	[3]342	360	390	[r]463	440
Vietnam[e]	980	880	[r]320	[r]500	250
Yemen (Aden)[e]	80	80	80	80	80
Yemen (Sanaa)[e]	155	160	[3]165	[3]231	[3]180
Yugoslavia	459	419	450	556	550
Total	[r]175,099	[r]190,070	191,628	194,730	195,594

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through July 8, 1988.

[2]Salt is produced in many other countries, but quantities are relatively insignificant and reliable production data are not available. Some salt brine production data for the manufacture of chlorine, caustic soda, and soda ash are not reported because of incomplete data reporting by many countries.

[3]Reported figure.

[4]Data are for year ending June 30 of that stated.

[5]Less than 1/2 unit.

[6]Data represent sales.

[7]Brine salt production as reported by the Burmese Government was as follows, in short tons: 1983—221,502; 1984—89,470; 1985—49,061; 1986—57,413; and 1987—70,289.

[8]Data are for year beginning Mar. 21 of that stated.

[9]Does not include production from Sardinia and Sicily, estimated at 220,000 short tons annually.

[10]Data are for fiscal year ending Mar. 31 of that stated.

[11]Crude salt.

[12]Data captioned "Brine salt" for the United Kingdom are the quantities of salt obtained from the evaporation of brines; that captioned "Other salt" are the salt content of brines used for purposes other than production of salt by evaporation.

TECHNOLOGY

The Alabama Electric Cooperative planned to develop the Nation's first compressed-air energy storage facility in a salt dome near McIntosh, AL. Electricity from coal-fired generators will drive compressors to store the air in solution-mined salt formations during periods of low energy demand. The energy would be reclaimed during peak demand periods by passing the air through a combustion turbine to generate electricity. The facility would generate 50 megawatts of electricity, have a storage capacity of 26 hours, and be in operation by 1989.[8]

[1]Physical scientist, Branch of Industrial Minerals.

[2]Free Press (Detroit, MI). Salt Division of Diamond Crystal Sold. July 30, 1987.

[3]Livonia Gazette (New York). Plans To Dump Ash Opposed by Salt Mine. Oct. 20, 1987.

[4]Chemical Marketing Reporter. V. 232, No. 26, Dec. 28, 1987, p. 35.

[5]European Chemical News. U.S. Cartel Tries To Halt Botswana Soda Ash Project. V. 49, No. 1297, Oct. 26, 1987, p. 6.

[6]Mining Magazine (London). World Highlights. Large Salt Find. V. 157, No. 2, 1987, p. 114.

[7]Industrial Minerals (London). Mineral Notes. Chinese Brine Deposit. No. 243, 1987, p. 94.

[8]The Daily Sentinel (Scottsboro, AL). Salt Dome is Storage Bin for Energy. Feb. 25, 1987.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1988—242-377/80049